

IN THE CLAIMS:

Claims 1-26 (canceled)

Claim 27 (currently amended) A longitudinal-torsional resonator comprising a connection point for receiving longitudinal vibration; a tip for contacting biological tissue; and at least one portion located between said ~~contact~~ connection point and said tip having a symmetrical spiral inhomogeneous cross section to comprise means for converting the longitudinal vibration into a longitudinal-torsional vibration.

Claim 28 (currently amended) A longitudinal-torsional resonator comprising a connection point for receiving longitudinal vibration; a tip for contacting biological tissue; and at least one portion located between said ~~contact~~ connection point and said tip having a symmetrical spiral inhomogeneous cross section to comprise means for converting the torsional vibration into a longitudinal-torsional vibration.

Claims 29-30 (canceled)

Claim 31 (new) A resonator of claim 27 where at least one hole extends from said tip to said connection point.

Claim 32 (new) A resonator of claim 28 where at least one hole extends from said tip to said connection point.

Claim 33 (new) An ultrasonic longitudinal-torsional tissue dissection system comprising an electro-mechanical transducer for receiving alternating electrical current and voltage from an ultrasonic generator, said transducer having a point of mechanical contact with a resonator, said transducer producing at said point of contact a single type of vibration selected from the group consisting of longitudinal vibration and torsional vibration, said resonator being mechanically joined to a tip shaped for cutting biological tissue, and at

least a portion of said resonator having an inhomogeneous cross section which converts the single type of vibration into a combined longitudinal-torsional vibration for imparting the longitudinal-torsional vibration to said tip.

Claim 34 (new) A system of claim 33 where said inhomogeneous portion comprises a section having a rectangular cross section having the shape of a helical spiral.

Claim 35 (new) A system of claim 33 where said inhomogeneous portion comprises a twisted flat bar.

Claim 36 (new) A system of claim 35 where said twisted flat bar is joined to an untwisted bar having a larger cross sectional area than said twisted bar to form a stepped half wavelength resonator.

Claim 37 (new) A system of claim 36 where said untwisted bar is connected to said transducer.

Claim 38 (new) A system of claim 33 where said inhomogeneous portion comprises a grooved round bar.

Claim 39 (new) A system of claim 33 where said inhomogeneous portion comprises a section having an elastic modulus that varies in a helical manner throughout said portion.

Claim 40 (new) A system of claim 33 where said inhomogeneous portion comprises a section having a density that varies in a helical manner throughout said portion.

Claim 41 (new) A system of claim 33 where said inhomogeneous portion comprises a section having an elastic modulus and density that vary in a helical manner throughout said portion.

Claim 42 (new) A system of claim 33 where said tip has a cutting edge.

Claim 43 (new) A system of claim 33 where a hollow longitudinal passageway extends completely through said tip and into said resonator.

Claim 44 (new) A system of claim 43 where a source of irrigation is connected to said passageway.

Claim 45 (new) A system of claim 43 where a vacuum source is connected to said passageway.

Claim 46 (new) A system of claim 43 where a slot is in said resonator communicating with said passageway, and an external flow line in flow communication with said slot.

Claim 47 (new) A system of claim 33 where said single type of vibration is longitudinal.

Claim 48 (new) A system of claim 33 where said single type of vibration is torsional.

Claim 49 (new) A system of claim 33 where the ratio of longitudinal-torsional vibration at said tip to the single type of vibration at said point of mechanical contact of said transducer with said resonator is in the range of 1 to 100.

Claim 50(new) A system of claim 33 where said inhomogeneous portion is tapered from a larger cross nearer to said transducer to a smaller cross section nearer to said tip.